We claim:

1. A polymer produced by providing one or more substrates selected from the group consisting of 3-hydroxybutyrate, 3-hydroxypropionate, 2-hydroxybutyrate, 3-hydroxyvalerate, 4-hydroxybutyrate, 4-hydroxyvalerate, 5-hydroxyvalerate, 3-hydroxyhexanoate, 4-hydroxyhexanoate, 6-hydroxyhexanoate and other longer chain 3-hydroxyacids containing seven or more carbons,

wherein the biological system expresses enzymes selected from the group consisting polyhydroxyalkanoate synthase, acyl-CoA transferase, hydroxyacyl CoA transferase, and hydroxyacyl CoA synthetase such that the polymers accumulate.

2. The polymer of claim 1 selected from the group consisting of poly(3-hydroxybutyrate-co-4-hydroxyvalerate), poly(4-hydroxyvalerate), poly(3-hydroxypropionate-co-5-hydroxyvalerate), poly(2-hydroxybutyrate), poly(2-hydroxybutyrate-co-3-hydroxybutyrate), poly(3-hydroxypropionate), produced in a biological system selected from the group comprising bacteria, yeasts, fungi and plants, wherein the biological system expresses enzymes selected from the group consisting polyhydroxyalkanoate synthase, acyl-CoA transferase and hydroxyacyl CoA transferase, and hydroxyacyl CoA synthetase such that the polymers accumulate in the presence of appropriate substrates.

3. The polymer of claim 1 wherein the polymer is poly(3-hydroxybutyrate-co-4-hydroxyvalerate).

4. The polymer of claim 1 wherein the polymer is poly(4-hydroxyvalerate).

5. The polymer of claim 1 wherein the polymer is poly(3-hydroxypropionate-co-5-hydroxyvalerate).

6. The polymer of claim 1 wherein the polymer is poly(3-hydroxypropionate).

7. A polyhydroxyalkanoate polymer comprising 2-hydroxybutyrate as a comonomer, wherein the polymer is produced in a biological system selected from the group comprising bacteria, yeasts, fungi

group consisting polyhydroxyalkanoate synthase, acyl-CoA transferase, hydroxyacyl CoA transferase, and hydroxyacyl CoA synthetase such that the polymers accumulate in the presence of appropriate substrates.

8. The polymer of claim 7 wherein the polymer is poly(2-hydroxybutyrate).

9. The polymer of claim 7 wherein the polymer is poly(2-hydroxybutyrate-co-3-hydroxybutyrate).

10. A method for making polymers in a biological system comprising

providing one or more substrates selected from the group consisting of 3-hydroxybutyrate, 3-hydroxypropionate, 2-hydroxybutyrate, 3-hydroxyvalerate, 4-hydroxybutyrate, 4-hydroxyvalerate, 5-hydroxyvalerate, 3-hydroxyhexanoate, 4-hydroxyhexanoate, 6-hydroxyhexanoate and other longer chain 3-hydroxyacids containing seven or more carbons,

wherein the biological system expresses enzymes selected from the group consisting polyhydroxyalkanoate synthase, acyl-CoA transferase, hydroxyacyl CoA transferase, and hydroxyacyl CoA synthetase such that the polymers accumulate.

11. The method of claim 10 wherein the organisms express one or more heterologous genes encoding the enzymes.

12. The method of claim 10 for making a copolymer of 3-hydroxybutyrate and 4-hydroxybutyrate comprising incubating equimolar amounts of (*R*)-3-hydroxybutyrate and 4-hydroxybutyrate with 4-hydroxybutyrate CoA transferase.